Covariation bias in women with a negative body evaluation

Covariation bias in women with a negative body evaluation: How is it expressed and can it be diminished?

Jessica M. Alleva

Maastricht University

Carolien Martijn

Maastricht University

Anita Jansen

Maastricht University

Author Note

Jessica M. Alleva, Department of Clinical Psychological Science, Maastricht University; Carolien Martijn, Department of Clinical Psychological Science, Maastricht University; Anita Jansen, Department of Clinical Psychological Science.

Correspondence regarding this article should be addressed to Jessica M. Alleva, Department of Clinical Psychological Science, Maastricht University, P.O. Box 616, 6200 MD Maastricht, The Netherlands. Telephone: 00 31 (0)43 3881609. E-mail: Jessica.Alleva@maastrichtuniversity.nl

Abstract

Background and Objectives: Women with a negative body evaluation display *covariation bias*: They overestimate the relation between their own body and negative social feedback. This study aimed to develop a more fine-grained understanding of this covariation bias and to determine whether it could be diminished. **Methods:** Seventy women completed a computer task wherein three categories of stimuli – pictures of their own body, a control woman's body, and a neutral object – were followed by (nonverbal) negative social feedback or nothing. Participants' estimates of the relation between each stimulus category and negative social feedback were assessed throughout the task. **Results:** Before starting the task, women with a more negative state body evaluation *expected* their body to be followed by more negative social feedback (demonstrating *a priori* covariation bias). During the task, when the relation between stimulus category and negative social feedback was random, women with a more negative trait and state body evaluation perceived at the present moment (*online* covariation bias) and retrospectively (*a posteriori* covariation bias) that their body was followed by more negative social feedback. When contingencies were manipulated so that women's own body was rarely followed by negative social feedback, covariation bias was temporarily diminished; this coincided with improvements in state body evaluation. **Limitations:** The task did not incorporate neutral or positive social feedback and focused only on undergraduate women. **Conclusions:** Covariation bias exists *preexperimentally* and occurs when situational information is ambiguous. It is possible to (temporarily) diminish covariation bias. This might be a technique for improving body evaluation.

Keywords: body evaluation, body image, covariation bias, cognitive processing, social feedback

1. Introduction

Individuals with a negative body evaluation (i.e., dissatisfaction with one's body) demonstrate distortions in cognitive processing (Cash, 2011), such as dichotomous thinking (e.g., in terms of fat vs. thin) and magnification of perceived flaws in appearance (Jakatdar, Cash, & Engle, 2006). These distortions in cognitive processing are related to greater psychological investment in one's appearance, preoccupation with being or becoming overweight, and pathological eating attitudes and behaviours (Jakatdar et al., 2006). Furthermore, distortions in cognitive processing reinforce and maintain negative body evaluation (Williamson, White, York-Crowe, & Stewart, 2004). For these reasons, investigating distortions in cognitive processing is important for understanding the aetiology and maintenance of negative body evaluation and how to alleviate it. The present study focuses, in particular, on covariation bias.

Covariation bias (often called *illusory correlation*) is a distortion in cognitive processing whereby an individual overestimates the contingency between a particular stimulus and an aversive outcome – even when the contingency is absent or is correlated in the opposite direction (Chapman & Chapman, 1967). Covariation bias has frequently been studied in individuals with an anxiety disorder or high levels of anxiety symptomatology. For example, in the classic covariation bias paradigm (Tomarken, Mineka, & Cook, 1989), individuals are presented with pictures belonging to three categories of stimuli: (a) spiders (fear-relevant), (b) snakes (fear-relevant), and (c) mushrooms or flowers (neutral). Across a series of trials, the pictures are followed by an electric shock (the aversive outcome), a tone (the nonaversive outcome), or nothing. Importantly, the contingencies between each stimulus category and each type of outcome are random. At the end of the task, participants estimate the percentage of trials of each stimulus category that were followed by each type of outcome. The key finding is that individuals who are highly fearful of spiders markedly overestimate the contingency between pictures of spiders and the electric shock, whereas their other estimates are quite accurate (Tomarken et al., 1989; see also De Jong & Merckelbach, 1993; De Jong, Merckelbach, & Arntz, 1995). This may reflect an underlying assumption that spiders are dangerous (Tomarken et al., 1989).

Alleva, Lange, Jansen, and Martijn (2014) demonstrated that negative body evaluation is associated with covariation bias as well. In their study, 65 women completed a computer task wherein pictures of their own body, a control woman's body, and a neutral object, were followed by nonverbal social feedback (i.e., facial crowds with equal numbers of negative, positive, and neutral faces). Their findings showed that women with a more negative body evaluation estimated higher levels of negative social feedback (the aversive outcome) for their own body (the stimulus), but not for the other stimuli (i.e., the control woman's body and the neutral object). In addition to reinforcing and maintaining body image distress in itself, such a covariation bias could cause women to inadvertently *elicit* negative social feedback from others (e.g., by avoiding eye contact), thereby further reinforcing negative body evaluation (Alleva et al., 2014; Tantleff-Dunn & Lindner, 2011).

The first aim of the present study is to develop a more fine-grained understanding of the covariation bias for the relation between women's own body and negative social feedback. Covariation bias can be expressed in three ways (Mayer, Muris, Freher, Stout, & Polak, 2012; Pauli, Montoya, & Martz, 1996; Pauli, Montoya, & Martz, 2001). *A priori covariation bias* refers to an individual's expectancy of a relation between a stimulus and an outcome, *before* the stimulus-outcome pairings have occurred or been presented (e.g., "When I arrive at the party, everyone will look at me and think I am unattractive;" Mayer et al., 2012). On the other hand, *online covariation bias* refers to an individual's *current* perception of a relation between a stimulus and an outcome (e.g., "Right now, everyone is looking at me and thinking I am unattractive;" Pauli et al., 2001). Lastly, *a posteriori covariation bias* refers to an individual's perception of a relation between a stimulus and an outcome *after* the stimulus-outcome pairings have occurred or been presented (e.g., "At the party last night, everyone looked at me and thought I was unattractive;" Tomarken et al., 1989). The covariation bias demonstrated by Alleva et al. (2014) was in fact an *a posteriori* covariation bias, as participants' covariation estimates were assessed at the end of the computer task.

Prior experimental research has shown that although both high and low fear individuals – that is, individuals with high and low scores on a measure of the pathology under investigation (e.g., spider phobia, panic disorder) – may demonstrate an *a priori* covariation bias for the relation between fear-relevant stimuli and an aversive outcome (e.g., Amin & Lovibond, 1997), only high fear individuals demonstrate an *a posteriori* covariation bias as well (e.g., Amin & Lovibond, 1997; Pauli et al., 1996; Pauli et al., 2001; Tomarken et al., 1989). These findings suggest that covariation bias exists *preexperimentally,* and is not merely formed during an experiment due to differential 'online' processing of stimuli (Amin & Lovibond, 1997; De Jong, Merckelbach, & Arntz, 1990; McNally & Heatherton, 1993). In addition, these findings suggest that high fear individuals are resistant to "disconfirming situational information" (i.e., the fact that there is absolutely no relation between the stimulus and the aversive outcome; Pauli et al., 1996), whereas low fear individuals do adjust their preexperimental estimates according to disconfirming situational information (Pauli et al., 1996). This would also explain why high fear individuals, but not low fear individuals, have been shown to display an online covariation bias as well (e.g., Pauli et al., 1996; Pauli et al., 2001). In the present study, we expected that women with a more negative body evaluation would demonstrate *a priori*, online, and *a posteriori* covariation biases.

The second aim of this study was to investigate if the covariation bias for the relation between women's own body and negative social feedback could be diminished. Pauli and colleagues (2001) showed that a covariation bias for fear-relevant stimuli (pictures of emergency situations) and an aversive outcome (electric shocks) could be abolished by manipulating the contingency between different types of stimuli and the aversive outcome. To do so, in a computer task, pictures of emergency situations were followed by shocks on a minority (17%) of trials, whereas fear-irrelevant stimuli were followed by shocks on a majority (83%) of trials. This manipulation successfully diminished the covariation bias found in high fear participants in a prior block of the experiment. Interestingly, the covariation bias did not return in a subsequent block where contingencies returned to random.

To our knowledge, Pauli et al.'s (2001) study is the only study to have reported a technique for diminishing covariation bias. Therefore, in the current study, we adapted Pauli et al.'s approach to try to diminish the covariation bias for the relation between women's own body and negative social feedback. That is, we created a computer task that was modelled as closely as possible to Pauli et al.'s computer task, but with stimuli (e.g., pictures of women's own body) and an aversive outcome (negative social feedback instead of an electric shock) that were specific for the covariation bias under investigation. In addition, to explore whether any changes in the covariation bias coincide with changes in body evaluation, we assessed women's state body evaluation throughout the computer task. We expected that the covariation bias in women with a more negative body evaluation would be diminished by the computer task, and that this change would persist when contingencies returned to random.

2. Material and Methods

2.1. Participants

Seventy-eight women participated in this study. Six participants were excluded from the dataset because they were aware of the study aim, one participant was excluded because her body mass index (BMI) indicated that she was obese (BMI = 34.26), and one participant was excluded because her BMI indicated that she was severely underweight (BMI = 15.57; BMI was calculated based on participants' self-reported weight and height). The final dataset comprised 70 women between 18 and 29 years (M_{age} = 22.30, *SD* = 2.66), with a BMI between 17.31 and 28.71 (M_{BMI} = 21.87, *SD* = 2.60). The majority of the participants were university students (80.0%).

2.2. Materials

2.2.1. Computer task. At the start of the computer task, participants were told that it was their job to determine the relation between three categories of pictures – their own body, another woman's body (i.e., the control woman's body), and a lamp (i.e., the neutral object) – and two outcomes: "negative portrait photos" (i.e., the negative social feedback), or nothing (i.e., a white screen). The computer task consisted of three blocks, each comprising 36 trials (12 trials per stimulus category). In Block 1, pictures of each category were followed by negative social feedback on 50% of trials (i.e., contingencies were random). In Block 2, pictures of women's own body and the control woman's body were each followed by negative social feedback on 17% of trials, and pictures of the neutral object were followed by negative social feedback on 83% of trials. Block 3 was identical to Block 1.

Pictures of each category were presented for six seconds each and the negative social feedback (or the white screen) was presented for two seconds. Pictures of the three categories were presented in random order; however, for Blocks 1 and 3, pictures of a given category were not presented on more than 2 consecutive trials. During each block, covariation estimates were assessed after each trial – immediately after the negative social feedback (or the white screen) disappeared – and before Block 1, after Block 2, and after Block 3. Base-rate estimates were collected at the end of each block. Block 1 started with three practice trials (using pictures of mushrooms) to familiarise participants with the computer task. In contrast to Pauli et al.'s (2001) version of the computer task, participants also filled in a measure of state body evaluation before Block 1, after Block 2, and after Block 3.

2.2.2. Pictorial stimuli. Three categories of pictures, consisting of three pictures each, were used for the computer task. The pictures of the participants' own body and the control woman's body were full-body pictures taken from the front and both sides. The control woman was a graduate student (approximate BMI = 22.50), wearing a black t-shirt and pants. Three pictures of a lamp (photographed from the front and sides) were chosen for the neutral object stimuli, because the shape of the lamp roughly resembled a human form. The negative social feedback was derived from the NimStim Facial Stimuli Set (Tottenham et al., 2009) and consisted of portrait photos of nine Caucasian men and nine Caucasian women, all frowning (mouth closed). Each portrait photo served as negative social feedback twice per block.

2.2.3. Covariation estimates. Three types of covariation estimates, concerning each category of stimuli, were collected during the computer task (cf. Pauli et al., 2001). *A priori* covariation estimates (collected before Block 1) concerned participants' estimates of the expected relationship between each category of stimuli and the negative social feedback (e.g., "How strongly do you expect that pictures of your own body will be followed by a negative (frowning) portrait photo?"). Online covariation estimates (collected during each block, after each trial) concerned participants' current estimates of the relationship between each category of stimuli and the negative social feedback (e.g., "You just saw a picture of your own body. How strongly do you expect that the next time you see a picture of your own body, it will be followed by a negative (frowning) portrait photo?"). *A posteriori* covariation estimates (collected after each block) concerned participants' estimates of the relationship between each category of stimuli and the negative social feedback during the now-completed block (e.g., "Given that you saw pictures of your own body, on what percentage of those trials was your own body followed by a negative (frowning) portrait photo?"). For each covariation estimate, participants indicated their answer by sliding a bar across a line on the computer screen, with end points 0 and 100 (e.g., 0 = *Definitely DO NOT expect that a negative portrait photo will follow pictures of my own body*, 100 = *Definitely DO expect that a negative portrait photo will follow pictures of my own body*).

2.2.4. Base-rate estimates. Base-rate estimates concerned participants' estimates of the percentage of trials (taking all stimulus categories together) that were followed by negative social feedback (e.g., "Taking all three categories of pictures together, on what percentage of trials were pictures followed by a negative (frowning) portrait photo?" cf. Pauli et al., 2001). These base-rate estimates were collected after each block. At the end of the computer task, participants also estimated the percentage of trials (across all three blocks) that concerned each stimulus category (e.g., "Taking all three blocks together, what percentage of the pictures presented were pictures of your own body?" cf. Pauli et al., 2001). Participants indicated their answers by sliding a bar across a line on the computer screen, with end points 0% and 100%. These base-rate estimates are necessary to ensure that the covariation bias is not explained by differences in participants' perception of the amount of negative social feedback or the number of trials of each stimulus category.

2.2.5. Body evaluation – trait. The Multidimensional Body-Self Relations Questionnaire – Appearance Scales (MBSRQ-AS; Brown, Cash, & Mikulka, 1990; Cash, 2000) was used to measure trait body evaluation. The MBSRQ-AS consists of 34 items rated on 5-point scales (1 = *definitely disagree*, 5 = *definitely agree*), and comprises five subscales: Appearance Evaluation, Appearance Orientation, Overweight Preoccupation, Self-Classified Weight, and Body Areas Satisfaction. For the purpose of this study, only items from the Appearance Evaluation Subscale (e.g., satisfaction with appearance; seven items) and Body Areas Satisfaction Subscale (e.g., satisfaction with various aspects of appearance; nine items) were administered (cf. Cash, 2000). Scores on the items of these two subscales were converted to Z-scores and were then averaged (cf. Cash, 2000); lower scores reflect a more negative trait body evaluation. In women 18 years and older, these two subscales have demonstrated good internal consistency and one-month test-retest reliability (Cash, 2000). The internal consistency for the items of these two subscales together was α = .90 in this sample.

2.2.6. Body evaluation – state. Two VAS items (Birkeland et al., 2005; Heinberg & Thompson, 1995) were used to measure state body evaluation. These items were, “Please rate your current level of physical appearance satisfaction,” and, “Please rate your current level of physical appearance dissatisfaction” (reverse-scored). Three mood-related items were included (cf. Birkeland et al., 2005) to disguise the focus of the questionnaire. Participants indicated their responses by sliding a bar across a line on the computer screen, with end points 0 = *none* and 100 = *extreme*. Participants’ responses to the two body evaluation items were averaged, with lower scores reflecting a more negative state body evaluation. These two items have demonstrated good 5-minute test-retest reliability and are sensitive to experimental manipulations (Birkeland et al., 2005). In this study, the internal consistency for these two items at all measurement points was good (M_α = .89, Range: α = .86 to .91).

2.3. Procedure

This study was approved by the university’s ethical committee. Participants were recruited using advertisements on campus and the university’s online participant recruitment system. At Session 1, participants signed an informed consent sheet and completed the measure of trait body evaluation. Participants were then asked to change into a black t-shirt and pants that were provided for them. Participants could choose their own size, ranging from small to extra large (t-shirts) and from 36 to 46 (pants). The clothing was athletic, stretchy, and close-fitting, but not skin-tight. After changing into the clothing, participants were photographed from the front and both sides in front of a white canvas. They were instructed to stand with their arms at their sides and to look straight into the camera with a neutral expression. At Session 2 (one week later), participants completed the computer task. Afterward, we conducted an awareness check to determine whether participants had guessed the aim of the study. Lastly, participants were given a 10 Euro voucher or participation credit. They were fully debriefed via e-mail at the end of data collection.

2.4. Statistical Analyses and Data Reduction

First, to investigate the presence of *a priori*, online, and *a posteriori* covariation biases, we conducted separate univariate regression analyses to test the relation between trait and state body evaluation and the covariation estimates. In particular, to investigate *a priori* covariation bias, we used participants' *a priori* covariation estimates. To investigate online covariation bias, we averaged participants' online covariation estimates (for each stimulus category separately) collected during Block 1. To investigate *a posteriori* covariation bias, we used participants' *a posteriori* covariation estimates collected after Block 1.

Second, to investigate whether Block 2 diminished the covariation bias, and whether this effect persisted at Block 3, we conducted separate univariate regression analyses to test the relation between trait and state body evaluation and the *a posteriori* covariation estimates that were collected after Block 2 and after Block 3.

For all of these analyses, separate analyses were conducted for trait body evaluation and state body evaluation (as measured before Block 1), with BMI as covariate. For each analysis, each predictor (e.g., trait body evaluation and BMI) was first entered into the model. Any predictors that did not significantly contribute to the model were subsequently removed from the model and the analysis was rerun. To check that the results were specific for covariation estimates in relation to women's own body, we additionally tested the relation between women's trait and state body evaluation and their covariation estimates for the control woman's body and the neutral object. We also tested the relation between women's trait and state body evaluation and their base-rate estimates.

To explore whether the manipulation in Block 2 coincided with changes in state body evaluation, we conducted a repeated measures ANCOVA, with Block (Block 1, Block 2, Block 3) as within-subjects factor and BMI as covariate. Note that Block 1, Block 2, and Block 3 refer to state body evaluation as measured immediately *after* Block 1, Block 2, and Block 3, respectively. For the purpose of this analysis, we created a median split on trait body evaluation, which was the between-subjects factor Group (participants with a more vs. less negative trait body evaluation). Greenhouse-Geisser corrections were applied whenever the assumption of sphericity was not met. To control for multiple testing, an alpha of .01 was chosen for all of the aforementioned analyses (Howell, 2009).

3. Results

3.1. *A Priori*, Online, and *A Posteriori* Covariation Biases

Trait body evaluation did not significantly predict women's *a priori* covariation estimates for their own body, B = -7.35, $t(68)$ = -2.28, p = .026, R^2= .07. However, trait body evaluation significantly predicted women's online, B = -12.16, $t(68)$ = -4.65, p < .001, R^2= .24, and *a posteriori* covariation estimates for their own body, B = -8.86, $t(68)$ = -2.87, p = .006, R^2= .11. State body evaluation significantly predicted women's *a priori*, B = -.43, $t(68)$ = -4.51, p < .001, R^2= .23, online, B = -.27, $t(68)$ = -2.95, p = .004, R^2= .11, and *a posteriori* covariation estimates for their own body, B = -.27, $t(68)$ = -2.70, p =.009, R^2= .10. Thus, women with a more negative body evaluation estimated higher levels of negative social feedback for their own body – *a priori* (predicted by state body evaluation only), online, and *a posteriori*. Note that BMI was not a significant covariate for these analyses and had been removed from the models (*p*s > .09).

To assess the specificity of these covariation biases for women's own body, we repeated the above analyses for the covariation estimates in relation to the control woman's body and the neutral object; none of these analyses proved significant (*p*s > .34). In addition, neither trait nor state body evaluation predicted women's base-rate estimates as assessed after Block 1 (*p*s > .30). That is, women's perception of the percentage of trials that were followed by negative social feedback did not depend on their trait or state body evaluation.

3.2. Covariation Bias Manipulation

After Block 2, in which we had attempted to manipulate the covariation bias, both trait body evaluation, $B = -4.18$, $t(68) = -1.13$, $p = .26$, $R^2 = .02$, and state body evaluation, $B = -.11$, $t(68) = -.94$, $p = .35$, $R^2 = .01$, no longer predicted women's covariation estimates for their own body, suggesting that the covariation bias had been diminished. However, after Block 3 (where contingencies returned to random), trait body evaluation again significantly predicted women's covariation estimates for their own body, $B = -11.85$, $t(68) = -3.70$, $p < .001$, $R^2 = .17$, suggesting that the covariation bias had returned. In contrast, state body evaluation did *not* predict women's covariation estimates for their own body after Block 3, $B = -.20$, $t(68) = -1.79$, $p = .08$, $R^2 = .05$. BMI was not a significant covariate for these analyses and was removed from the models (*p*s > .50).

We repeated the above analyses for the covariation estimates in relation to the control woman's body and the neutral object (after Block 2 and Block 3); none of these analyses proved significant (*p*s > .18). Also, neither trait nor state body evaluation predicted women's base-rate estimates as assessed after Block 2 and Block 3 (*p*s > .03). Thus, there were no differences between women of various levels of trait and state body evaluation scores regarding their perception of the percentage of trials that were followed by negative social feedback and the percentage of trials of each stimulus category.

3.3. Changes in State Body Evaluation

The results of the analyses (Figure 1) showed a nonsignificant Block x Group interaction, $F(1.56, 106.22) = .85$, $p = .41$. The results also showed a significant main effect of Group, $F(1, 68) = 26.62$, $p < .001$, indicating that participants who scored lower on trait body evaluation also scored lower on state body evaluation (as would be expected). In addition, the results showed a significant main effect of Block, $F(1.56, 106.22) = 14.87$, $p < .001$. Planned comparisons indicated that there was a significant increase in state body evaluation from after Block 1 to after Block 2, $t(69) = -4.09$, $p < .001$, and that state body evaluation did not change from after Block 2 to after Block 3, $t(69) = .36$, $p = .72$. These results demonstrate that all participants experienced an improvement in state body evaluation from before to after manipulation of the covariation bias, and that this improvement was maintained until the end of the computer task. Again, BMI was not a significant covariate in the analysis, $p = .35$, and had been removed from the model.

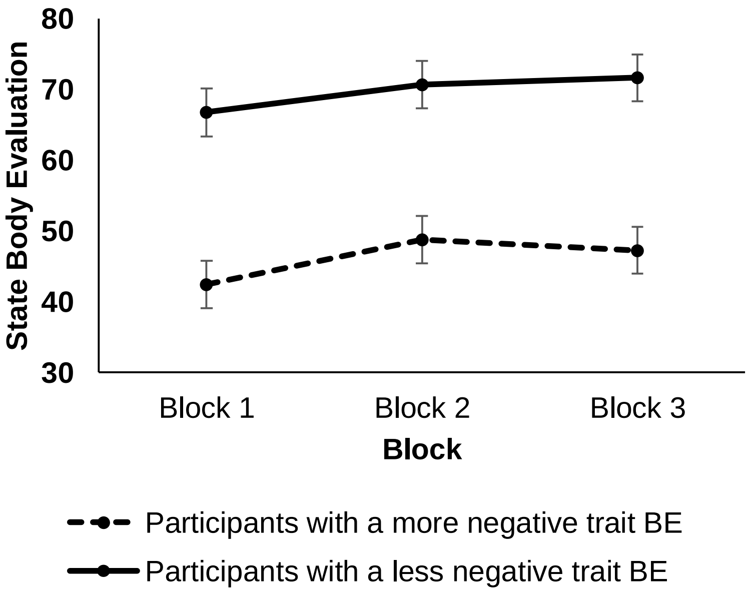

Figure 1. Participants' state body evaluation across the computer task. Block 1 and Block 2 refer to state body evaluation immediately before and after manipulation of the covariation bias, respectively. Block 3 refers to state body evaluation immediately after Block 3, where contingencies returned to random. BE = body evaluation. Error bars represent standard errors.

3.4. Descriptive

Lastly, to provide additional insight into participants' covariation estimates across the computer task, we plotted participants' online covariation estimates for the 12 trials (per block) in which their own body was presented (Figure 2). We plotted the data separately for participants with a more vs. less negative trait body evaluation (using a median split, as aforementioned). The figure appears to confirm the analyses. That is, women with a more negative body evaluation gave higher covariation estimates for their own body (Block 1), and covariation estimates decreased during manipulation of the covariation bias. However, at Block 3, participants' covariation estimates seem to have returned to their initial levels.

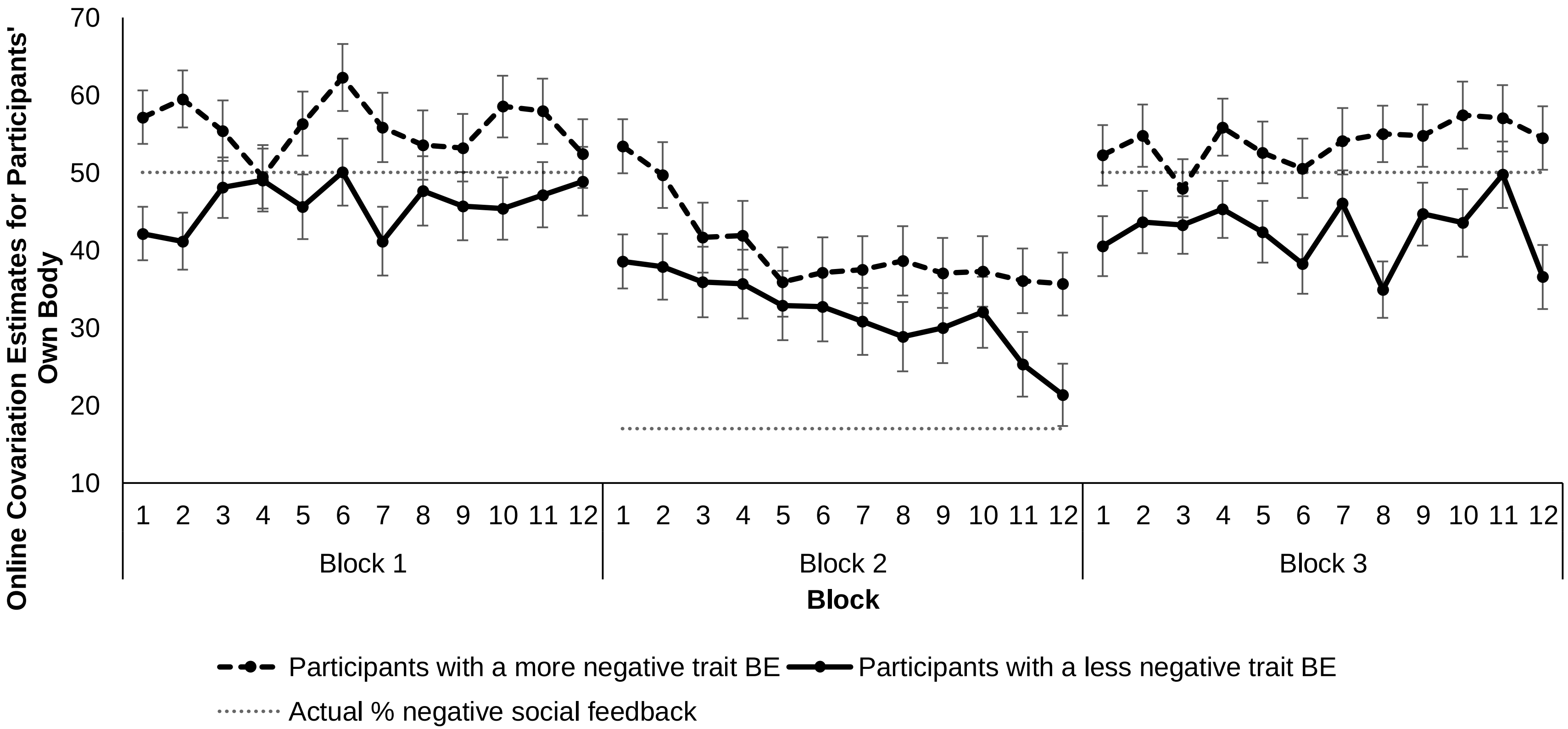

Figure 2. Participants' online covariation estimates for their own body across the course of the computer task. Each block comprised 12 trials in which the participants' own body was presented. At Block 1, the participants' own body was followed by negative social feedback on 50% of trials (i.e., contingencies were random). At Block 2, the participants' own body was followed by negative social feedback on 17% of trials. Block 3 was identical to Block 1. BE = body evaluation. Error bars represent standard errors.

4. Discussion

The present study aimed to develop a more fine-grained understanding of the covariation bias for the relation between women's own body and negative social feedback, and to determine whether this covariation bias could be diminished. We found that women with a more negative body evaluation demonstrate *a priori* (as predicted by state body evaluation only), online, and *a posteriori* covariation biases. These findings were specific for women's own body. Also, women's perception of the percentage of trials that were followed by negative social feedback and the percentage of trials of each stimulus category did not depend on their trait or state body evaluation. Furthermore, we found that the covariation bias could be diminished – at least temporarily – and that state body evaluation improved as well.

4.1. *A Priori*, Online, and *A Posteriori* Covariation Biases

These findings replicate those of Alleva et al. (2014) in which it was demonstrated that women with a more negative body evaluation display an *a posteriori* covariation bias for the relation between their own body and negative social feedback. However, we extended these findings by showing that women with a more negative body evaluation also display *a priori* covariation bias (as predicted by state body evaluation only) and online covariation bias. The present findings are also in line with those of prior studies conducted in individuals with anxiety symptomatology (e.g., Amin & Lovibond, 1997; Pauli et al., 1996), in that we showed that online and *a posteriori* covariation biases are restricted to individuals scoring high on the pathology under investigation (here, women with a more negative body evaluation).

Taken together, the present findings suggest that covariation bias exists *preexperimentally* in women with a more negative body evaluation. Furthermore, the expectation that their own body will be followed by negative social feedback seems resistant to disconfirming situational information (i.e., the fact that there was absolutely no relation between their own body and negative social feedback) – specifically, when situational information is more ambiguous (e.g., when contingencies are 50%). Why might this be? One explanation concerns *self-schemas*, which are an “integrated set of memories, beliefs, and generalizations about one’s behaviour in a given domain” (Kunda, 1999, p. 452). Self-schemas influence how individuals process information about themselves and others: Individuals tend to process information in a manner that serves to *maintain* their self-schemas (see Kunda, 1999, for details). Individuals also possess a self-schema about their body (i.e., a *body-schema*; Cash, 2011). Women with a more negative body evaluation likely have a body-schema that is characterised by negative generalisations and beliefs about their body (Altabe & Thompson, 1996). In line with self-schema research, a negative body-schema should cause women to process information in a manner that is consistent with, and maintains, their body-schema (Altabe & Thompson, 1996; Cash, 2011) – including resisting “counterschematic” information (Markus, 1977). This might be why the covariation bias in women with a more negative body evaluation persisted during Block 1 of this study.

4.2. Diminishing the Covariation Bias

Using an adapted version of Pauli et al.’s (2001) computer task, we were able to diminish the covariation bias for the relation between women’s own body and negative social feedback – at least on the very short term. This finding is promising because it suggests that the covariation bias may be malleable under certain circumstances. In this case, it could be that greatly reducing the contingency between women’s own body and negative social feedback (to 17%) made it abundantly clear to participants that their own body was in fact rarely followed by negative social feedback. In contrast, when contingencies were random (50%), there may have been more ‘room’ for participants’ biases in cognitive processing to play a role. Indeed, prior studies have suggested that covariation bias only occurs when situational information is ambiguous (i.e., when contingencies are random; Alloy &

Tabachnik, 1984; Pauli et al., 2001; Pauli et al., 1996). This may also explain why the covariation bias seemed to have returned in Block 3 (as predicted by trait body evaluation), when contingencies had returned to random.

It is noteworthy that participants' state body evaluation improved after manipulation of the covariation bias and that this improvement persisted until the end of the computer task. This finding suggests that manipulating the covariation bias might be a potential technique for improving body evaluation. Furthermore, this finding demonstrates that diminishing the covariation bias may cause improvements in body evaluation, supporting the role of covariation bias in the maintenance of negative body evaluation. However, this does not explain why *all* participants – not just women with a more negative trait body evaluation – experienced an improvement in state body evaluation. It could be that the experience of having one's body *rarely* followed by negative feedback has a beneficial impact on women's state body evaluation, regardless of whether or not they possess a covariation bias. Future research is necessary to determine whether these findings replicate across studies.

Lastly, it is important to note that some deviations were found in the results between trait and state body evaluation. As aforementioned, only state body evaluation predicted women's *a priori* covariation estimates, and only trait body evaluation predicted the re-emergence of the covariation bias at Block 3. One reason for this divergence might be due to the measures used in this study. The two subscales that were used to assess trait body evaluation capture a range of aspects related to body evaluation (e.g., satisfaction with various body areas), whereas the VAS items that were used to assess state body evaluation focus on participants' overall feelings of appearance satisfaction. In addition, trait body evaluation was assessed at Session 1, whereas state body evaluation was assessed at Session 2. It is currently unclear whether trait or state body evaluation provides a more reliable picture of the relations under investigation. Future research may clarify whether these divergences persist across studies.

4.3. Limitations

To our knowledge, Pauli and colleagues (2001) are the only researchers that have developed a computer task for diminishing covariation bias. Given this fact, and the demonstrated effectiveness of this computer task, we modelled our computer task as closely as possible to Pauli et al.'s computer task. Consequently, we only used negative social feedback (vs. nothing) as outcome stimuli. However, a more ecologically valid version of the computer task might also incorporate positive and neutral social feedback (cf. Alleva et al., 2014), and future research will benefit from investigating such an alternative version of the present computer task. Another limitation of this study is that it is unclear how long the effects of the computer task on the covariation bias last, as trait body evaluation predicted the re-emergence of the covariation bias at Block 3. This is perhaps unsurprising considering the persistence of the covariation bias and the tendency of self-schemas to direct cognitive processing in a schema-consistent manner. Future research could investigate strategies for strengthening the computer task, for example by administering it over multiple sessions. Lastly, we tested women between 18 and 30 years old, so it is unclear whether similar results would be found in other age groups or in men.

4.4. Conclusions

Despite the aforementioned limitations of this study, the present findings are noteworthy because they provide evidence for *a priori*, online, and *a posteriori* covariation biases in women with a more negative body evaluation. In addition, the findings show that the covariation bias can be (temporarily) diminished, and that state body evaluation seems to improve as well. More broadly, the current study provides further insight into covariation bias, and how it may affect women's experience of their own body.

Acknowledgements

We would like to thank Paul Pauli for providing additional details about the computer task, Jacco Ronner for programming the computer task for this study, and Suzanne Rattay for her help with testing participants. The contribution of Jessica M. Alleva was supported by NWO grant 404-10-118: Novel strategies to enhance body satisfaction, awarded to Carolien Martijn.

References

Alleva, J. M., Lange, W. G., Jansen, A., Martijn, C. (2014). Seeing ghosts: Negative body evaluation predicts overestimation of negative social feedback. *Body Image, 11*, 228-232. doi:10.1016/j.bodyim.2014.03.001

Alloy, L. B., & Tabachnik, N. (1984). Assessment of covariation in humans and animals: The joint influence of prior expectations and current situational information. *Psychological Review, 91,* 112-149. doi:10.1037/0033-295X.91.1.112

Altabe, M., & Thompson, J. K. (1996). Body image: A cognitive self-schema construct? *Cognitive Therapy and Research, 20,* 171-193. doi:10.1007/BF02228033

Amin, J. M., & Lovibond, P. F. (1997). Dissociations between covariation bias and expectancy bias for fear-relevant stimuli. *Cognition & Emotion, 11,* 273-289. doi:10.1080/026999397379926

Birkeland, R., Thompson, J. K., Herbozo, S., Roehrig, M., Cafri, G., & Van den Berg, P. (2005). Media exposure, mood, and body image dissatisfaction: An experimental test of person versus product priming. *Body Image, 2,* 53-61. doi:10.1016/j.bodyim.2004.11.002

Brown, T. A., Cash, T. F., & Mikulka, P. J. (1990). Attitudinal body image assessment: Factor analysis of the Body-Self Relations Questionnaire. *Journal of Personality Assessment, 55,* 135-144. doi: 10.1207/s15327752jpa5501&2_13

Cash, T. F. (2000). *Multidimensional Body-Self Relations Questionnaire users' manual (3rd revision).* Available from the author at www.body-images.com.

Cash, T. F. (2011). Cognitive-behavioral perspectives on body Image. In T. F. Cash & L. Smolak (Eds.), *Body image: A handbook of science, practice, and prevention* (pp. 39-47). New York, NY: Guilford Press.

Chapman, L. J., & Chapman, J. P. (1967). Genesis of popular but erroneous psychodiagnostic observations. *Journal of Abnormal Psychology, 72,* 193-204.

De Jong, P. J., & Merckelbach, H. (1993). Covariation bias, classical conditioning, and phobic fear. *Integrative Physiological and Behavioral Science, 28,* 167-170. doi:10.1007/BF02691222

De Jong, P. J., Merckelbach, H., & Arntz, A. (1990). Illusory correlation, on-line probability estimates, and electrodermal responding in a (quasi)-conditioning paradigm. *Biological Psychology, 31,* 201-212. doi:10.1016/0301-0511(90)90034-T

De Jong, P. J., Merckelbach, H., & Arntz, A. (1995). Covariation bias in phobic women: The relationship between a priori expectancy, on-line expectancy, autonomic responding, and a posteriori contingency judgment. *Journal of Abnormal Psychology, 104,* 55-62. doi:10.1037/0021-843X.104.1.55

Heinberg, L. J., & Thompson, J. K. (1995). Body image and televised images of thinness and attractiveness: A controlled laboratory investigation. *Journal of Social and Clinical Psychology, 14,* 325-338. doi:10.1521/jscp.1995.14.4.325

Howell, D. C. (2009). *Statistical methods for psychology* (7th ed.) Boston, MA: Cengage Learning.

Jakatdar, T. A., Cash, T. F., & Engle, E. K. (2006). Body-image thought processes: The development and initial validation of the Assessment of Body-Image Cognitive Distortions. *Body Image, 3,* 325-333. doi:10.1016/j.bodyim.2006.09.001

Kunda, Z. (1999). *Social cognition: Making sense of people.* Cambridge, MA: MIT press.

Markus, H. (1977). Self-schemata and processing information about the self. *Journal of Personality and Social Psychology, 35,* 63-78. doi:10.1037/0022-3514.35.2.63

Mayer, B., Muris, P., Freher, N. K., Stout, J., & Polak, M. (2012). Covariation bias for food-related control is associated with eating disorders symptoms in normal adolescents.

Journal of Behavior Therapy and Experimental Psychiatry, 43, 1008-1013. doi:10.1016/j.jbtep.2012.03.007

McNally, R. J., & Heatherton, T. F. (1993). Are covariation biases attributable to a priori expectancy biases? *Behaviour Research and Therapy, 31,* 653-658. doi:10.1016/0005-7967(93)90118-E

Pauli, P., Montoya, P., & Martz, G. E. (1996). Covariation bias in panic-prone individuals. *Journal of Abnormal Psychology, 105,* 658-662. doi:10.1037/0021-843X.105.4.658

Pauli, P., Montoya, P., & Martz, G. E. (2001). On-line and a posteriori covariation estimates in panic-prone individuals: Effects of a high contingency of shocks following fear-irrelevant stimuli. *Cognitive Therapy and Research, 25,* 23-36. doi:10.1023/A:1026470514475

Tantleff-Dunn, S., & Lindner, D. M. (2011). Body image and social functioning. In T. F. Cash & L. Smolak (Eds.), *Body image: A handbook of science, practice, and prevention* (pp. 263-270). New York, NY: Guilford Press.

Tomarken, A. J., Mineka, S., & Cook, M. (1989). Fear-relevant selective associations and covariation bias. *Journal of Abnormal Psychology, 98,* 381-394. doi:10.1037/0021 843X.98.4.381

Tottenham, N., Tanaka, J., Leon, A. C., McCarry, T., Nurse, M., Hare, T. A., . . . Nelson, C. A. (2009). The NimStim set of facial expressions: Judgments from untrained research participants. *Psychiatry Research, 168,* 242-249. doi:10.1016/j.psychres.2008.05.006

Williamson, D. A., White, M. A., York-Crowe, E., & Stewart, T. M. (2004). Cognitive behavioral theories of eating disorders. *Behavior Modification, 28,* 711-738. doi:10.1177/0145445503259853